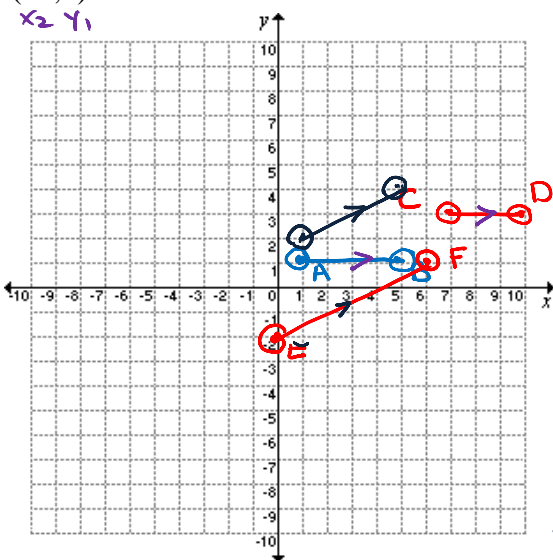


Name: _____

Date: _____

Math 10F&PC Chapter 6 Linear Functions**6.2– Slope Of Parallel and Perpendicular Lines****Focus:** Generalize and apply a rule for determining whether two lines are parallel or perpendicular.**Investigation #1:** What does parallel mean? \rightarrow two lines has the same slopeParallel \therefore two lines on the same Flat surface that do not intersectOn the grid below, plot the lines AB and CD and calculate the slopes. x_1, y_1 x_2, y_2 x_1, y_1 intersect
A(1,1); B(5,1); C(7,3); D(10,3).

Slope AB =

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{slope} = \frac{1 - 1}{5 - 1} = \frac{0}{4} = 0$$

Horiz. line

Slope CD =

AB & CD are parallel

$$\frac{3 - 3}{10 - 7} = \frac{0}{3} = 0$$

Horiz. line

On the same grid above, plot the lines EF and GH.

E(0,-2); F(6,1); G(1,2); H(5,4).

 x_1, y_1 x_2, y_2 x_1, y_1 x_2, y_2 Parallel lines

Slope EF =

$$\text{slope} = \frac{1 - -2}{6 - 0}$$

$$= \frac{3}{6} = \boxed{\frac{1}{2}}$$

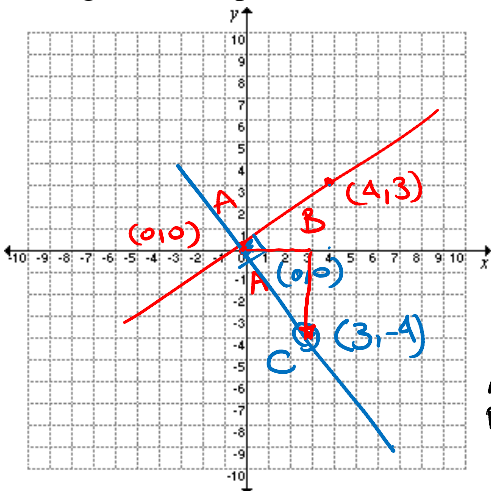
Slope GH =

$$\frac{4 - 2}{5 - 1} = \frac{2}{4} = \boxed{\frac{1}{2}}$$

both has same slope

What did you find?

We Found that line AB & CD has the same slope
line EF & GH has the same slope } they parallel

Investigation #2:What does PERPENDICULAR mean? lines that intersect at right angle.On the grid below, plot the line AB. x_1, y_1 x_2, y_2
A(0,0); B(4,3).

$$\text{Slope AB} = \frac{3 - 0}{4 - 0} = \boxed{\frac{3}{4}}$$

Now, rotate point B 90° clockwise to create two perpendicular lines. The new point C(3, -4)

$$\text{Slope AC} = \frac{-4 - 0}{3 - 0} = \boxed{\frac{-4}{3}}$$

AB

$$A(0,0) \Rightarrow (x_1, y_1)$$

$$B(4,3) \Rightarrow (x_2, y_2)$$

$$\text{slope} = \frac{-4 - 0}{3 - 0} = \boxed{\frac{-4}{3}}$$

$$\text{slope} = \frac{0 - -4}{0 - 3} = \frac{4}{-3} = \boxed{\frac{-4}{3}}$$

Compare the slope of AB and AC. What conclusion can you make about slopes of perpendicular lines?

$$\text{slope of AB} = \boxed{\frac{3}{4}}$$

$$\text{slope of AC} = \boxed{\frac{-4}{3}}$$

line AB slope of $\frac{3}{-8}$

\perp line slope of $\frac{8}{3}$

Example 1: Is line MN parallel or perpendicular to line PQ if the coordinates of all points are:

M(5,-1); N(2,3) and P(2,-2); Q(-1,-6)
 x_1, y_1 x_2, y_2 x_1, y_1 x_2, y_2

Find the slope of each line

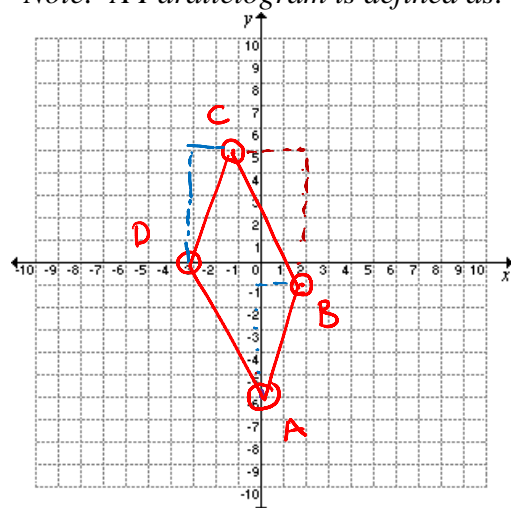
$$\text{slope of MN} = \frac{3 - (-1)}{2 - 5} = \boxed{\frac{4}{-3}}$$

$$\text{slope of PQ} = \frac{-6 - (-2)}{-1 - 2} = \frac{-4}{-3} = \boxed{\frac{4}{3}}$$

Example 2: Determine whether the quadrilateral with vertices

A(0, -6), B(2, -1), C(-1, 5) and D(-3, 0) is a parallelogram.

Note: A Parallelogram is defined as: opposite sides are _____ & _____



$$\begin{aligned} \text{slope of AB} &= \frac{5}{2} \\ \text{slope of CD} &= \frac{5}{2} \end{aligned} \left. \vphantom{\begin{aligned} \text{slope of AB} &= \frac{5}{2} \\ \text{slope of CD} &= \frac{5}{2} \end{aligned}} \right\} \text{Parallel}$$

$$\begin{aligned} \text{slope of AD} &= \frac{6}{-3} = \boxed{-2} \\ \text{slope of BC} &= \frac{6}{-3} = \boxed{-2} \end{aligned} \left. \vphantom{\begin{aligned} \text{slope of AD} &= \frac{6}{-3} = \boxed{-2} \\ \text{slope of BC} &= \frac{6}{-3} = \boxed{-2} \end{aligned}} \right\} \text{Parallel}$$

AB // CD & AD // BC
 \therefore ABCD is parallelogram

Example 3: Determine the slope of a line that is perpendicular to a line passing through

S(6, 3); T(-1, -6).

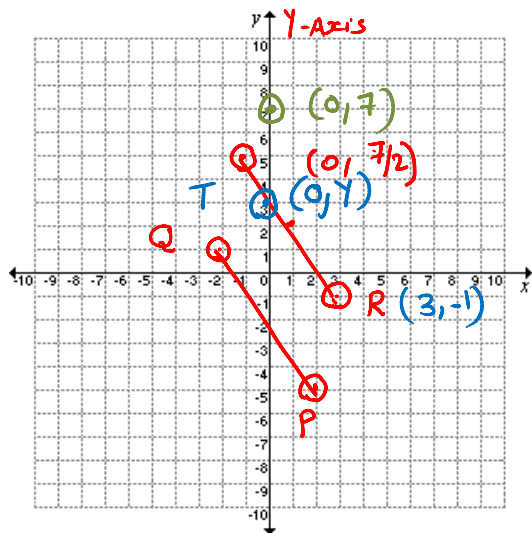
x_1, y_1 x_2, y_2

1) Calculate the slope of ST then calculate the slope of \perp of ST

$$\bullet \text{ slope of ST} = \frac{-6 - 3}{-1 - 6} = \frac{-9}{-7} = \boxed{\frac{9}{7}}$$

$$\text{slope of } \perp \text{ to ST} = \boxed{\frac{-7}{9}}$$

Example 4: The points P(2, -5), Q(-2, 1), and R(3, -1) are given. Find the coordinates of a point T on the y-axis so that segment RT is parallel to PQ.



① Find the slope of PQ

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-5)}{-2 - 2} = \frac{6}{-4}$$

$$\text{slope} = \left[-\frac{3}{2} \right]$$

$$\text{slope of TR} = -\frac{3}{2}$$

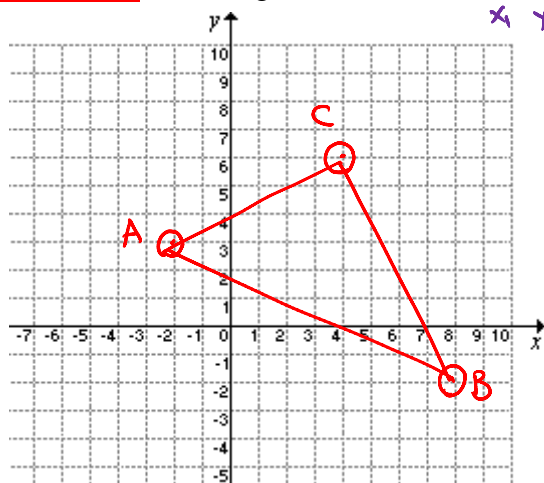
Point R (x_1, y_1) = (3, -1) Point T (x_2, y_2) = (0, y_2)

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$-\frac{3}{2} = \frac{y - (-1)}{0 - 3} \quad \therefore -\frac{3}{2} \neq \frac{y+1}{-3}$$

$$2(y+1) = (-3)(-3) \quad \therefore 2y+2=9 \quad 2y=7 \quad \boxed{y = \frac{7}{2}}$$

Example 5: A triangle has vertices A(-2, 3), B(8, -2) and C(4, 6). Is it a right triangle?



① slope of AC = $\frac{y_2 - y_1}{x_2 - x_1}$
A(x_1, y_1) = (-2, 3) C(x_2, y_2) = (4, 6)

$$\text{slope} = \frac{6 - 3}{4 - (-2)} = \frac{3}{6} = \left[\frac{1}{2} \right]$$

② slope of BC

B(x_1, y_1) = (8, -2) C(x_2, y_2) = (4, 6)

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-2)}{4 - 8} = \frac{8}{-4} = \left[-\frac{2}{1} \right]$$

$$\text{slope of AC} = \frac{1}{2}$$

$$\text{slope of BC} = -\frac{2}{1}$$

$$\therefore AC \perp BC$$

$\therefore \triangle ABC$ is Right triangle

Example 6: A line segment has endpoint $C(6, 2)$ and $D(8, 5)$.

a) Point P is such that PC is parallel to CD. Find the coordinates of P if P is on the:

i) y-axis

ii) x-axis

slope of CD

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 2}{8 - 6} = \frac{3}{2}$$

For P on the y-axis: $P(0, y)$, $C(6, 2)$

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - y}{6 - 0} = \frac{3}{2}$$

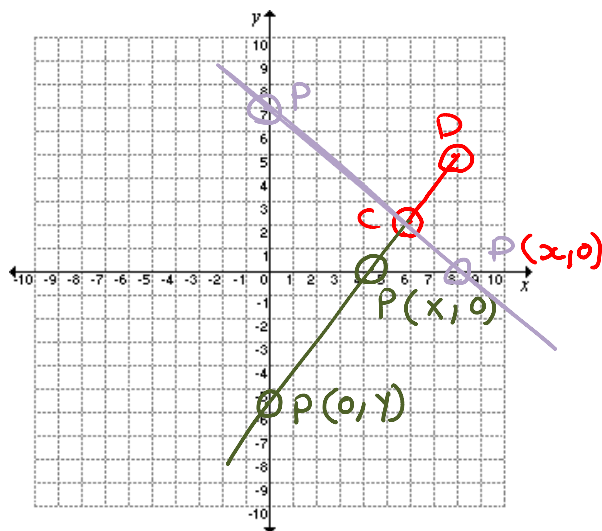
$$\frac{3}{2} = \frac{2 - y}{6} \Rightarrow 18 = 4 - 2y \Rightarrow 14 = -2y \Rightarrow y = -7$$

For P on the x-axis: $P(x, 0)$, $C(6, 2)$

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 0}{6 - x} = \frac{3}{2}$$

$$\frac{3}{2} = \frac{2}{6 - x} \Rightarrow 18 - 3x = 4 \Rightarrow -3x = -14 \Rightarrow x = \frac{14}{3}$$

Answers: $P(0, -7)$ and $P(\frac{14}{3}, 0)$



b) Point P is such that PC is perpendicular to CD. Find the coordinates of P if P is on the:

i) y-axis

ii) x-axis

iii) CHALLENGE: the 45° line of $y = x$

For P on the y-axis: $P(0, y)$, $C(6, 2)$

$$\text{slope of PC} = \frac{2 - y}{6 - 0} = -\frac{2}{3}$$

$$\text{slope of CD} = \frac{3}{2}$$

$$-\frac{2}{3} \cdot \frac{3}{2} = -1$$

For P on the x-axis: $P(x, 0)$, $C(6, 2)$

$$\text{slope of PC} = \frac{2 - 0}{6 - x} = -\frac{2}{3}$$

$$\text{slope of CD} = \frac{3}{2}$$

$$-\frac{2}{3} \cdot \frac{3}{2} = -1$$

Answers: $P(0, -7)$ and $P(9, 0)$

Using Slope to Identify a Polygon

Example 7:

Is quadrilateral ABCD a trapezoid?

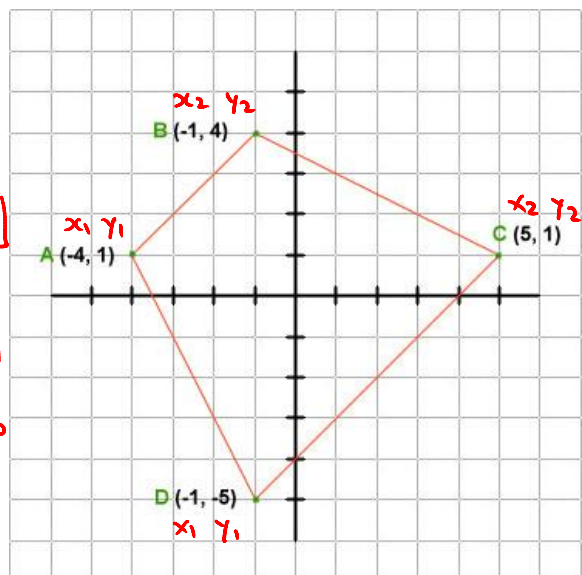
Note: A trapezoid has one pair of parallel sides.

slope of AB = $\frac{4 - 1}{-1 - (-4)} = \frac{3}{3} = 1$

slope of DC = $\frac{1 - (-5)}{5 - (-1)} = \frac{6}{6} = 1$

$\therefore AB \parallel DC$ have same slope

$\therefore ABCD$ is a Trapezoid



Assignment: p. 349 #8, 10 – 12, 13, 17, 19, 22, 23

Quiz on 6.1, 6.2
next day